



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/551,843

09/27/2006

Tadahiro Ohmi

010986.56896US

5817

23911 7590 08/13/2008  
CROWELL & MORING LLP  
INTELLECTUAL PROPERTY GROUP  
P.O. BOX 14300  
WASHINGTON, DC 20044-4300

EXAMINER

WITHERS, GRANT S

ART UNIT

PAPER NUMBER

2895

MAIL DATE

DELIVERY MODE

08/13/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/551,843	<b>Applicant(s)</b> OHMI ET AL.	
	<b>Examiner</b> GRANT S. WITHERS	<b>Art Unit</b> 2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 26 July 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3-11 and 13-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 3-11 and 13-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

This Office Action is in response to the Amendment filed on 01/14/2008.

Currently, claims 1, 3-11, 13-24 are pending.

The finality of the previous office action is withdrawn and prosecution is reopened with this final taking the place of the previous.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3-7 11, 13-17, and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. ("Lee" US 2006/0194451, entitled to date 07/30/2003), further in view of Hamelmann et al. ("Hamelmann" Hamelmann, F. "W/Si multilayers deposited by hot-filament MOCVD" Thin Solid Films 338 (1999) pp 70-74).

As to claims 1, 3-7, 11, 13-17, and 21-24 Lee shows (See Fig. 3C) forming a  $\text{MSi}_{xM}\text{O}_{yM}\text{N}_{zM}$  layer high-k gate dielectric on and between a Si substrate and a gate (poly 3; Fig. 4; page 3, [0039]) by first forming  $\text{MSi}_{xM}\text{O}_{yM}$  and then plasma nitriding (plasma  $\text{N}_2$ ; Fig. 3D) the  $\text{MSi}_{xM}\text{O}_{yM}$ . Lee also shows a silicon nitride barrier layer (B; Fig 3D; page 3, [0031]) formed between the Si substrate and gate insulation film, wherein the barrier layer is formed by direct nitridation (plasma  $\text{N}_2$ ; Fig. 3C) by plasma, wherein a silicon nitride film (T; Fig. 3D; page 3, [0038]) is disposed on the gate insulation film in an alternately laminated

structure, and wherein a buffer layer (I; Fig. 3A; page 2, [0025]) is formed between the Si substrate and the gate insulation film.

Lee fails to specifically show that the actual deposition process (rather than a subsequent implantation to the deposited layer) is plasma CVD.

Hamelmann teaches depositing MOCVD layers with assistance of plasma (See paragraphs 1 and 2 discussing MOCVD of Si and using plasma PECVD in the second paragraph).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used the method of depositing MOCVD layers as taught by Hamelmann to have deposited the MOCVD layers in Lee with the motivation of reducing the substrate temperature (substrate temp can be reduced; paragraph 2, page 70).

Claims 8, 9, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. ("Lee" US 2006/0194451, entitled to date 07/30/2003), further in view of Hamelmann et al. ("Hamelmann" Hamelmann, F. "W/Si multilayers deposited by hot-filament MOCVD" Thin Solid Films 338 (1999) pp 70-74) as applied to claims 1, 3-7, 11, 13-17, and 21-24 above, and further in view of Inoue et al. ("Inoue" US 2004/0031985, 04/19/2004).

As to claims 8, 9, 18 and 19, Lee, as modified by Hamelmann, shows the methods of claims 1 and 11 above but fail to show forming an AlO<sub>2</sub> layer that is formed by plasma CVD between the nitride layer and the substrate.

Inoue shows forming an  $\text{AlO}_2$  layer between a nitride layer and a substrate by plasma CVD ( $\text{Al}_2\text{O}_3$ ; Fig. 3; [0026]).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used a high permittivity material as taught by Inoue to have replaced the buffer layer of Lee with the motivation of enabling the formation of a thinner gate insulator film (enable thin film; [0011]).

Claims 10 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. ("Lee" US 2006/0194451, entitled to date 07/30/2003), further in view of Hamelmann et al. ("Hamelmann" Hamelmann, F. "W/Si multilayers deposited by hot-filament MOCVD" Thin Solid Films 338 (1999) pp 70-74) as applied to claims 1, 3-7 11, 13-17, and 21-24 above, and further in view of Huppertz et al. ("Huppertz" Huppertz, Hubert "Ba<sub>2</sub>Nd<sub>7</sub>Si<sub>11</sub>N<sub>23</sub> – A Nitridosilicate with a Zeolite-analogous Si-N Structure, Angew. Chem. Int. Ed. Engl. 1997, Vol. 36, No. 23, pg. 2651-2).

As to claims 10 and 20, Lee, as modified by Hamelmann, shows the method of claims 1 and 11 above but fails to show using specifically Ba<sub>2</sub>Nd<sub>7</sub>Si<sub>11</sub>N<sub>23</sub> as a metal silicon nitride layer.

Hubert teaches using Ba<sub>2</sub>Nd<sub>7</sub>Si<sub>11</sub>N<sub>23</sub> (synthesis of Ba<sub>2</sub>Nd<sub>7</sub>Si<sub>11</sub>N<sub>23</sub>; not shown; page 2651, column 2, [0007]).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used the method of forming Ba<sub>2</sub>Nd<sub>7</sub>Si<sub>11</sub>N<sub>23</sub> as taught by Hubert to have made the metal silicon nitride layer in Lee, as modified

by Hamelmann with the motivation of forming a highly stable layer (highly stable; not shown; page 2651, [0005]).

### ***Response to Arguments***

Applicant's arguments, see Arguments, filed 07/10/2008, with respect to the allowability of the claims have been fully considered but unfortunately upon conversing with the signatory examiner the claims previously indicated as being allowable unfortunately have issues that were unforeseen. Therefore, a new rejection has been made above. In addition to the rejection above it should be noted that the plasma nitridation that takes place in Lee could possibly be considered making the MOCVD process in Lee a "plasma CVD formation" process and then Lee shows all features of the independent claims, however, in the interests of avoiding unnecessary argument a rejection under U.S.C 103 has been made.

Applicant's amendment in the reply dated 01/14/2008 necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GRANT S. WITHERS whose telephone number is (571)270-1570. The examiner can normally be reached on Mon-Thurs 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles D. Garber can be reached on (571)-272-2194. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Application/Control Number: 10/551,843  
Art Unit: 2895

Page 7

GSW  
07/26/2008

/N. Drew Richards/

Supervisory Patent Examiner, Art Unit 2895